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A look at the air-water response in a wave tank with fish oil

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Surfactant layers with viscoelastic properties floating on the water surface damp short gravity-capillary waves. Inspired by the known virtue of fish oil to still angry seas, a laboratory study has been made on wind wave generation and on the interaction between wind-waves, paddle-waves and airflow in a tank containing a thin fish oil film uniformly spread on the water surface. According to the Marangoni resonance-type damping mechanism, for oily surfaces the energy dissipation process is quite selective in wavenumbers, but its effects are not, since it spreads (although to a lesser extent) towards longer and shorter waves via nonlinear interactions and modification of the airflow profile. With a thin layer of oil on the surface, it is rather peculiar that in the wind-only condition (no paddle waves) the wave field does not grow from the rest condition. This equilibrium was altered by paddle (longer) waves, the generation and evolution of short waves (in clean water and with oil) being modified by their interaction with the orbital velocity of the longer waves and their effect on the airflow. Paddle waves did grow under the action of wind, how much being similar in clean and oily water conditions, a fact we ascribe to the similar distortion of the wind profile in the two cases. We have also found that wind-supported stress on the oily water surface was able to generate a surface current, whose magnitude turns out to be comparable to the one in clean water. Our results expand previous investigations on the same topic. We stress the benefit of experiments with surfactants to explore in detail the physics at, and the exchanges across, the wavy and no-wavy air-water interface.

Reference
Benetazzo, A., Cavaleri, L., Ma, H., Jiang, S., Bergamasco, F., Jiang, W., Chen, S., and Qiao, F.: Fish oil in a wave tank: a look at the air-water response, Ocean Sci. Discuss., https://doi.org/10.5194/os-2018-111, in review, 2019.